

Environmental controls on the distribution of long-chain alkenones in the Canadian Prairies: Insights for the development of the lacustrine alkenone-based temperature proxy

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Long-chain alkenones (LCAs) have a great potential for temperature reconstructions in lakes, but the presence of different haptophyte species within and among lakes prevents the application of a global lacustrine temperature calibration. This problem can be overcome by creating an *in-situ* calibration from filtered water samples, using environmental genomics to determine which species of haptophytes are present, and using enrichments or isolated algal cultures to generate a culture-based temperature calibration.

Here, we investigated how the abundance and composition of alkenones in surface sediments from 106 lakes varied with environmental conditions in lakes of the Northern Great Plains in Saskatchewan, Canada. LCAs are common in these Canadian lakes, with 55% of surveyed lakes containing alkenones and mean concentration of 143 $\mu\text{g g}^{-1}$ dry sediment. Redundancy analyses indicate that LCAs are more abundant in sulfate-rich and stratified lakes, consistent with studies from Spain and the North American Great Plains. Almost all alkenone-containing lakes (93%) have a profile dominated by $\text{C}_{37,4}$ alkenones, suggesting the presence of one main haptophyte species from Group II phylotype and the potential of these lakes for the development of a temperature proxy. The presence of other species from Group I and Group II phylotypes was also confirmed by genomic analyses, although neither species were particularly common. In initial calibrations, the alkenone unsaturation index (U_{37}^K) was not correlated with average summer water temperature, probably because summer does not correspond to the timing of maximum alkenone production by haptophytes. We conclude that an *in-situ* approach is needed with improved seasonal sampling to calibrate the U_{37}^K index with the appropriate environmental temperature.